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Remarks

The following remarks are provided in further support of the Claims.

Rejections

## Rejection Under 35 U.S.C. §102(b)

Claims 1, 2, 7, 9-12 and 14 are rejected under 35 USC 102(b) as being anticipated by Smirniotis et al. ("Low Temperature Selective Catalytic Reduction of NO with NH<sub>3</sub>..")

## Rejection Under 35 U.S.C. §103

Claim 3 is rejected under 35 U.S.C. §103(a) as being unpatentable over Smirniotis et al. in view of Dosch et al. (U.S. Patent No. 5,461,022).

Claims 4, 5, and 15-17 are rejected under 35 U.S.C. §103(a) as being unpatentable over Smirniotis et al. in view of Gardner et al. (U.S. Patent No. 6,165,934).

Claims 6, 8 and 13 are rejected under 35 U.S.C. §103(a) as being unpatentable over Smirniotis et al. in view of Gardner et al. ("Ammonia/urea Selective Catalytic Reduction for Mobile Diesel Engines").

I. DISCUSSION (Rejection Under 35 USC 102(b), Smirniotis)

Smirniotis et al. teaches a method for selective catalytic reduction (SCR) of NO with NH<sub>3</sub> using Mn, Cr, and Cu oxides supported on Hombikat TiO<sub>2</sub>, SiO<sub>2</sub>, or Al<sub>2</sub>O<sub>3</sub> (see, e.g., page 2480, Table 1). In the method of the present invention, nitrogen oxides are reduced by using Cu or Mn oxides that are supported on an activated hydrous titanium oxide (HTO) support. These HTO supports are not the same as the

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Hombikat  $\text{TiO}_2$  supports; they in fact have substantially different characteristics that produce different results when used for catalytically reducing nitrogen oxide compounds by exposing a gas comprising nitrogen oxides in the presence of  $\text{NH}_3$  to a catalyst comprising an active component selected from  $\text{CuO}$ ,  $\text{Mn}$  and oxides of  $\text{Mn}$  on a HTO support, as described in Claim 1.

In particular, in the Specification page 14, lines 5-18, results are described using both the Hombikat  $\text{TiO}_2$  and the HTO:Si support where the HTO:Si-supported  $\text{Mn-WO}_3$  formulation is more resistant to hydrothermal aging than the equivalent Hombikat  $\text{TiO}_2$  formulation. It is well known in the art that different supports can produce different conversion and selectivity results using similar metals and loading. This is also evidenced by the different results obtained using a Degussa P25  $\text{TiO}_2$  support compared with the HTO:Si support as discussed in the Specification on page 17 lines 20-22 through page 18, lines 1-2.

The use of different supports can also not produce significantly different results, as described on page 18, lines 7-12. The results described in the Specification therefore demonstrates that the Hombikat  $\text{TiO}_2$  support is not the same as the HTO:Si support and therefore the method of Smirniotis et al. discloses a method with elements that are different than the method of the instant Specification and Smirniotis et al does not anticipate the method of the present invention as described in claim 1, and claims 2, 7, 9-12, and 14, dependent on claim 1.

## II. DISCUSSION (Rejection Under 35 USC 103(a), Smirniotis et al. in view of Dosch et al.)

Dosch et al. teach a method of making a thin film hydrous metal oxide catalyst, where the catalyst is noted as potentially being useful for a variety of catalytic processes. Dosch et al. claim, but provide no evidence for, the utility of using the thin film hydrous metal oxide catalysts for the reduction of nitrogen oxides. Dosch et al. describe these catalysts as using metals selected from the group of platinum, palladium, nickel, molybdenum and rhodium. Dosch et al. do not discuss

the use of CuO, Mn, and oxides of Mn on a hydrous metal oxide support for any application.

The Office states that "Dosch et al. teaches having Mo as a promoter for the catalyst and loading 1% of Mo onto the hydrous titanium oxide catalyst". The Office also states that "Smirniotis et al. teaches using Mo as a promoter on a titanium oxide catalyst..". In Smirniotis, the Mo is the catalytic material (i.e., the catalyst) and the Hombikat TiO<sub>2</sub> is the support material for the catalytic material. Neither Smirniotis et al. nor Dosch et al. teach Mo as a promoter for the catalyst; in the teachings of Dosch et al. cited by the Office, Mo is again the catalyst. For the NiMo system discussed in Column 8, lines 9-33, where nominal loadings of 1% Mo and 0.3% Ni are put onto the support, the Mo and Ni are both catalytic materials. In the method of the present invention, Mn, oxides of Mn and CuO are used as the catalysts, with MoO<sub>3</sub> and WO<sub>3</sub> optionally added as promoters to reduce the activation energy for the Mn, oxides of Mn and CuO catalytic materials and thereby promote greater catalytic activity by those metals and metal oxides.

The method of the present invention teaches the use of the materials Mn, oxides of Mn and CuO on a hydrous titanium oxide support and claim 3 specifies the use of a promoter selected from WO<sub>3</sub> and MoO<sub>3</sub>. Neither Smirniotis et al. or Dosch et al. teach the use of a promoter and specifically the promoter compounds specified in claim 2. As discussed in claim 1, Smirniotis et al. discusses the use of a support material, Hombikat TiO<sub>2</sub>, which is not the same as the support material of the present invention, namely the hydrous metal oxide materials. While Dosch et al. discuss the use of the hydrous metal oxide materials as a support, Dosch et al. do not teach nor suggest the use of Mn, oxides of Mn and CuO materials on a hydrous metal oxide support, and do not teach the use of a promoter in conjunction with those materials. Therefore, Smirniotis et al. in view of Dosch et al. do not teach nor suggest the method of Claim 3 of the present invention.

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III. DISCUSSION (Rejection Under 35 USC 103(a), Smirniotis et al. in view of Gardner et al., US Patent No. 6,165,934)

Gardner et al. teach a material and system for the catalytic reduction of nitrogen oxides using catalytic metals selected from platinum, palladium and mixtures thereof with a copper promoter compound. Gardner et al. also teach the formation of hydrous titanium oxide/silica support material. It is the support material that includes silica, as described by Preparation 1 and Preparation 2 of Gardner et al. in Columns 12 and 13. Claim 4 has been modified to clarify that the inclusion of silica refers to inclusion of silica in the support. The hydrous titanium oxide/silica support materials taught by Gardner et al. are in fact similar to the hydrous metal oxide/silica support materials taught by the method of the present invention. However, Gardner et al. do not teach the use of Mn, oxides of Mn, and CuO as the catalytic materials used to catalytically reduce nitrogen oxides; Gardner et al. teach only the use of platinum and palladium catalytic materials. The Mn, oxides of Mn and CuO materials used in the method of the present invention have substantial advantages over the material system taught by Gardner et al., including lower cost and better aging characteristics (as shown, for example, in Figs. 3, 5 and 10 of the instant specification).

Therefore, neither Smirniotis et al. nor Gardner et al. teach or suggest the use of Mn, oxides of Mn and CuO materials on hydrous metal oxide supports for use in the reduction of nitrogen oxides as described by claim 1 and therefore do not teach or suggest the dependent claims 4, 5, and 15-17 which further limit claim 1 by requiring the use of silica as part of the support in the catalytic system.

IV. DISCUSSION (Rejection Under 35 USC 103(a), Smirniotis et al. in view of Gardner et al., "Ammonia/Urea Selective Catalytic Reduction for Mobile Diesel Engines")

The teachings of Smirniotis et al. have been discussed in Sections I-III. Smirniotis et al. teaches the use of a Mo catalytic material on a Hombikat TiO<sub>2</sub> support material. The method of the present invention, in the independent claim 1, teaches the use of Mn, oxides of Mn, and CuO catalytic materials on a hydrous metal oxide support

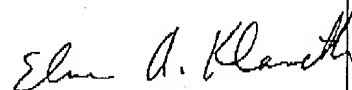
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to form a catalyst which can be exposed to nitrogen oxides in a gaseous state in the presence of  $\text{NH}_3$  to reduce the nitrogen oxide compounds. Smirniotis et al. do not teach nor suggest the method of the present invention as described in claim 1. Claims 6, 8, and 13 further limit claim 1 by specifying the concentration of nitrogen oxides and  $\text{NH}_3$ . Therefore, Smirniotis et al. in view of Gardner do not teach or suggest the use of Mn, oxides of Mn, and CuO catalytic materials on a hydrous metal oxide support to form a catalyst which can be exposed to nitrogen oxides that can have a concentration less than approximately 1000 parts per million (as limited in claim 6) in a gaseous state in the presence of  $\text{NH}_3$  that occurs from the thermal decomposition of urea (as limited in claim 8) wherein the  $\text{NH}_3$  concentration can be approximately equal to the nitrogen oxides concentration (as limited in claim 13) to reduce the nitrogen oxide compounds.

#### CONCLUSION

Applicants have responded to each and every rejection raised by the Office and, in concurrence with the Office, consider that claims 1-17 are now in condition for allowance. Applicants request expeditious processing to issuance.

Respectfully submitted,



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